2/28/17

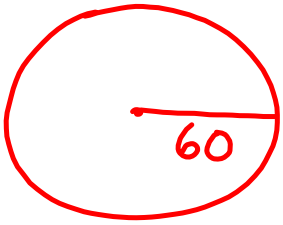
"Its easy to be happy when people do what they're supposed to."- Chris Callahan

HW: Related Rates Word Problems #2

AIM: How do we solve Related Rate problems?

Warm Up:

1. Assume that oil spilled from a ruptured tanker spreads in a circular pattern whose radius increases at a constant rate of 2 ft/sec. How fast is the area of the spill increasing when the radius of the spill is 60 ft?



What We Know

$r = 60\text{ft}$

$\frac{dr}{dt} = 2\ ft/s$

What we need

$\frac{dA}{dt}$

What equation relates the information we have/need?

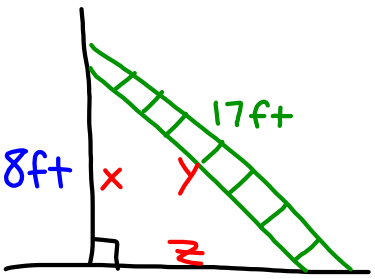
$A = \pi r^2$

$\frac{dA}{dt} = 2\pi r \frac{dr}{dt}$ Plug in values

$\frac{dA}{dt} = 2\pi(60\text{ft})\left(2\ ft/s\right)$

$\frac{dA}{dt} = 240\pi\ ft^2/s$

3 A 17-foot ladder is leaning against a wall. If the bottom of the ladder is pulled along the ground away from the wall at a constant rate of 5ft/sec, how fast will the top of the ladder be moving down the wall when it is 8 feet above the ground?



Ladder doesn't size change

Know:

$y = 17$ ft $\quad \frac{dy}{dt} = 0$

$x = 8$ ft

$z = 15$ ft $\quad \frac{dz}{dt} = 5$ ft/s

Need: $\frac{dx}{dt}$

5 ft/s →

What equation relates the need/know?

$$x^2 + z^2 = y^2$$

Need to find z

$x^2 + z^2 = y^2$

$8^2 + z^2 = 17^2$

$64 + z^2 = 289$

$z^2 = 225$

$z = 15$

$$2x\frac{dx}{dt} + 2z\frac{dz}{dt} = 2y\frac{dy}{dt}$$

$$2(8)\frac{dx}{dt} + 2(15)(5) = 2(17)(0)$$

$$16\frac{dx}{dt} + 150 = 0$$

$$16\frac{dx}{dt} = -150$$

$$\frac{dx}{dt} = -\frac{150}{16} = -9.375 \text{ ft/s}$$

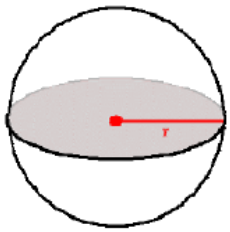
implies negative

The ladder is moving down the wall @ 9.375 ft/sec

Question: A spherical snowball with an outer layer of ice melts so that the *volume* of the snowball decreases at a rate of 2 cm^3/min.

(a) How *fast is the radius changing* when diameter of the snowball is 10 cm?

(b) How fast is **surface area** of the snowball *decreasing* at this time?

	The **volume** of a sphere is given by the equation: $$V = \frac{4}{3}\pi r^3$$	The **surface area** of a sphere is given by the equation: $$S = 4\pi r^2$$

2. A spherical balloon is to be deflated so that its radius decreases at a constant rate of 15 cm/min. At what rate must air be removed when the radius is 9cm?